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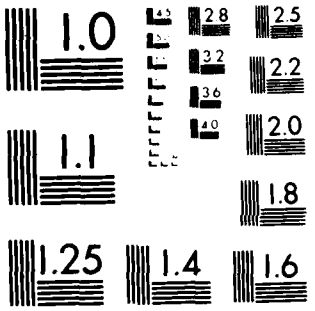

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This is a study of the backscattering characteristics of an inhomogeneous medium with irregular boundaries. As such rough boundary surface scattering effects and their modeling are of basic importance to this problem. Also, of equal importance is the interaction between surface and volume scattering. The objective in studying the above problem is to arrive at practically useful scattering models for earth terrains which could provide information for the design of experiments, for the discrimination problem between target and terrain background, for studying the sensitivity of radar backscatter to terrain parameters, for extrapolating and interpolating existing data, and for relating observations to their physical causes.

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Backscattering From Inhomogeneous Media With Irregular Boundaries

Final Report

RSL TR 485-Final Report

October 1983

Principal Investigator: A.K. Fung

Contract Number: DAAG29-80-K-0018

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I. STATEMENT OF THE PROBLEM

This is a study of the backscattering characteristics of an inhomogeneous medium with irregular boundaries. As such rough boundary surface scattering effects and their modeling are of basic importance to this problem. Also, of equal importance is the interaction between surface and volume scattering.

The objective in studying the above problem is to arrive at practically useful scattering models for earth terrains which could provide information for the design of experiments, for the discrimination problem between target and terrain background, for studying the sensitivity of radar backscatter to terrain parameters, for extrapolating and interpolating existing data, and for relating observations to their physical causes.

II. SUMMARY OF MAJOR RESULTS

In the past volume and surface scattering are two separate fields of study. For terrain modeling it is necessary to employ techniques from both fields, since in general both types of scattering are present. For example, a vegetated terrain could generate volume scattering from the vegetation layer and generate surface scattering from the underlying rough ground surface. The first successful terrain scattering model which combines appropriately the surface and volume scattering effects has been published in 1981 [Fung and Eom, 1981b]. An additional approach to modeling both surface and volume scattering has also been published by Fung and Chen [1981]. Applications of these scattering models and their extensions to vegetation, snow and sea ice have been demonstrated in subsequent years [Fung and Eom, 1982a, 1983c; Eom and Fung, 1983a]. These models have also been applied to study the terrain polarization characteristics for

the purpose of target-clutter discrimination [Fung and Eom, 1982b, 1983b].

Surface scattering models for rough surfaces with a wide range of rms surface heights have been tested [Fung and Eom, 1981a] and demonstrated to be of practical value [Fung and Eom, 1981c] for natural soil surfaces.

To provide references to scattering from rough surfaces and inhomogeneous media, review articles have been written which summarize the current status and needed research in rough surface modeling [Fung, 1981a, 1982b] and random media modeling [Fung, 1981b, 1982a].

Extensions of existing surface and volume scattering models have been carried out to treat (1) non-Gaussian statistics [Eom and Fung, 1983b], (2) multi-layered media with irregular boundaries [Karam and Fung, 1982a], and (3) effects of sphericity on coherent scattering [Fung and Eom, 1983a]. Related studies to estimate terrain parameters through average power measurements (the inverse problem) have also been carried out [Fung, 1983a]. In addition, the estimation of total loss due to scattering and absorption in a random medium has been worked out for the vector problem [Karam and Fung, 1982b].

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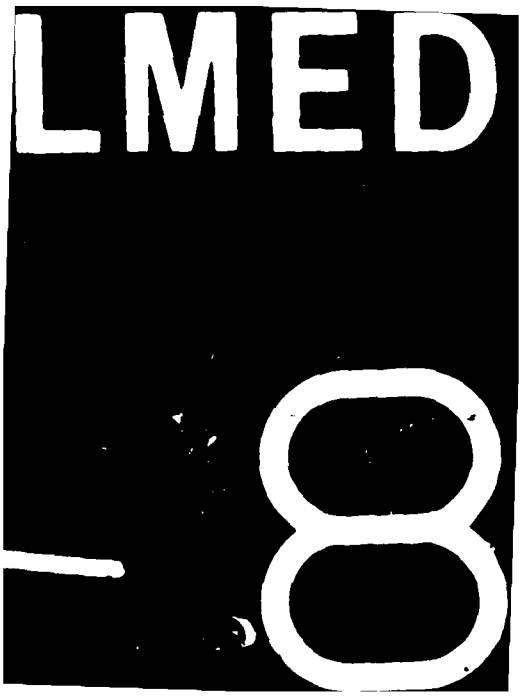
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